

JUL 11 2006

PTO/SB/64 (10-05)

Approved for use through 07/31/2006; OMB 0601-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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**PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT
ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(b)**

Docket Number (Optional)
BSSNP09

First named inventor: Hermann Tropol

Application No.: 10/529,174

Art Unit:

Filed: 03/23/2005

Examiner:

Title: Detection and Gripping of Objects

Attention: Office of Petitions
Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
FAX (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (571) 272-3282.

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus an extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:

- (1) Petition fee;
- (2) Reply and/or issue fee;
- (3) Terminal disclaimer with disclaimer fee - required for all utility and plant applications filed before June 8, 1995; and for all design applications; and
- (4) Statement that the entire delay was unintentional.

1. Petition fee

☒ Small entity-fee \$ 750.00 (37 CFR 1.17(m)). Applicant claims small entity status. See 37 CFR 1.27.

☐ Other than small entity - fee \$ _____ (37 CFR 1.17(m))

2. Reply and/or fee

A. The reply and/or fee to the above-noted Office action in the form of Declaration, Translations (Application, Preliminary Amend.) (identify type of reply):

☐ has been filed previously on _____
☒ is enclosed herewith.

B. The issue fee and publication fee (if applicable) of \$ _____

☐ has been paid previously on _____
☐ is enclosed herewith.

(Page 1 of 2)

This collection of information is required by 37 CFR 1.137(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 172 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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JUL 11 2006

PTO/SB/64 (10-05)

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3. Terminal disclaimer with disclaimer fee

- ☒ Since this utility/plant application was filed on or after June 8, 1995, no terminal disclaimer is required.
- ☐ A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of \$ _____ for a small entity or \$ _____ for other than a small entity) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

4. STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional. [NOTE: The United States Patent and Trademark Office may require additional information if there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137(b) was unintentional (MPEP 711.03(c), subsections (III)(C) and (D)).]

WARNING:

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Signature

Thomas Champagne
Typed or printed name

12 1/2 Wall Street, Suite 1
Address

Asheville, NC 28801
Address

07/11/2006
Date

36,478
Registration Number, if applicable

828-253-8800
Telephone Number

Enclosures: ☐ Fee Payment☒ Reply☐ Terminal Disclaimer Form☐ Additional sheets containing statements establishing unintentional delay☒ Other: Fee transmittal, Notice of Missing Requirements

CERTIFICATE OF MAILING OR TRANSMISSION [37 CFR 1.8(a)]

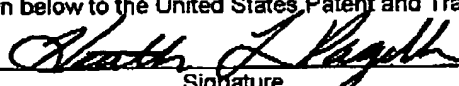
I hereby certify that this correspondence is being:

☐ Deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Mail Stop Petition, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450.

☒ Transmitted by facsimile on the date shown below to the United States Patent and Trademark Office as (571) 273-8300.

07/11/2006

Date



Signature

Heather L. Pagella
Typed or printed name of person signing certificate

[Page 2 of 2]

JUL 11 2006

Approved for use through 07/31/2006 OMB 0651-0032

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Effective on 12/09/2004.

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4018).

FEE TRANSMITTAL
For FY 2005**Complete if Known**

Application Number	10/529,174
Filing Date	03/23/2005
First Named Inventor	Hermann Tropf
Examiner Name	
Art Unit	
Attorney Docket No.	BSSNP09

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 750.00

METHOD OF PAYMENT (check all that apply)☐ Check ☐ Credit Card ☐ Money Order ☐ Nonus ☐ Other (please identify):☒ Deposit Account Deposit Account Number: 501998 Deposit Account Name: IP Strategies

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below☐ Charge fee(s) indicated below, except for the filing fee☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17☒ Credit any overpayments

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FEE CALCULATION**1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims Extra Claims Fee (\$)

- 20 or HP = x Fee Paid (\$)

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims Extra Claims Fee (\$)

- 3 or HP = x Fee Paid (\$)

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets Extra Sheets Number of each additional 50 or fraction thereof Fee (\$)

- 100 = / 50 = (round up to a whole number) x Fee Paid (\$)

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other (e.g., late filing surcharge): Petition for revival fee

750.00

SUBMITTED BY

Signature	Registration No. 38,478 (Attorney/Agent)	Telephone 828-253-8600
Name (Print/Type): Thomas M. Champagne		Date 07/11/2008

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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JUL 11 2006

PTO/SB/17 (12-04/2)

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Effective on 12/09/2004.

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

**FEE TRANSMITTAL
For FY 2005**☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 750.00

Complete if Known

Application Number	10/529,174
Filing Date	03/23/2005
First Named Inventor	Hermann Trops
Examiner Name	
Art Unit	
Attorney Docket No.	BSSNP09

METHOD OF PAYMENT (check all that apply)

- ☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____
- ☒ Deposit Account Deposit Account Number: 501998 Deposit Account Name: IP Strategies
- For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)
- ☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee
- ☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

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FEE CALCULATION**1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180
Total Claims	Extra Claims	Fee (\$)
- 20 or HP = _____ x _____ = _____		
HP = highest number of total claims paid for, if greater than 20.		
Indep. Claims	Extra Claims	Fee (\$)
- 3 or HP = _____ x _____ = _____		
HP = highest number of independent claims paid for, if greater than 3		
	Multiple Dependent Claims	Fee (\$)
		Fee Paid (\$)

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

<u>Total Sheets</u>	<u>Extra Sheets</u>	<u>Number of each additional 50 or fraction thereof</u>	<u>Fee (\$)</u>	<u>Fee Paid (\$)</u>
- 100 = _____	/ 50 = _____	(round up to a whole number) x _____	= _____	

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other (e.g., late filing surcharge): Petition for revival fee**Fees Paid (\$)**

750.00

SUBMITTED BY

Signature	<u>Thomas M. Champagne</u>	Registration No. (Attorney/Agent)	38,478	Telephone	828-253-8600
Name (Print/Type)	Thomas M. Champagne	Date	07/11/2006		

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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JUL 11 2006

DECLARATION FOR UTILITY PATENT APPLICATION (37 CFR 1.63)/POWER OF ATTORNEY

First Named Inventor: Hermann Tropf Attorney Docket Number: BSSNP09
 Application Number: ☐ Declaration Submitted with Initial Filing
 Filing Date: ☒ Declaration Submitted after Initial Filing
 Group Art Unit: (surcharge (37 CFR 1.16 (e)) required)
 Examiner Name:

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter that is claimed and for which a patent is sought on the invention entitled:

Detection and Gripping of Objects
the specification of which☐ Is attached hereto.

OR

☒ was filed on 09/18/2003 (MM/DD/YYYY) as U.S. Application Number or PCT International Application Number PCT/EP2003/010411 and was amended on 09/23/2005 (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information that is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information that became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application that designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Foreign Filing Date (MM/DD/YYYY)	Country	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
PCT/EP2003/010411	09/18/2003	WO	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
102 44 275.4	09/23/2002	DE	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
103 38 323.9	08/21/2003	DE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I hereby appoint Thomas M. Champagne (Reg. No. 36,478) as agent to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Please direct all correspondence to:

IP STRATEGIES
 12 1/2 Wall Street, Suite 1
 Asheville, North Carolina 28801
 828.253.8600
 828.253.8620 fax

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR: Hermann Tropf
 Given Name(s) Family Name or Surname
19 April 2005
 Inventor's Signature Date

Residence: Blumenstrasse 5
 or Mailing Street Address
 Address St. Leon-Rot
 City 68789 State DE Country
 ZIP/Postal Code Citizenship

IP STRATEGIES, Asheville, North Carolina

WO 2004029864

Hermann Tropf

T50323PC US

Sensing and Gripping Objects

5 The invention relates to sensing, gripping or processing unordered or badly ordered or inaccurately positioned parts, particularly, bulk parts, preferably by means of a robotic device or other manipulator devices.

10 On this subject there is a wealth of, mostly academic, literature mainly involved with methods of image processing. The methods employed for image analysis are mostly contour-oriented and model-based. Contour-based methods furnish, as compared to surface-based methods, in general, results which are more stable and precise and are needed as a rule for partly concealed workpieces. In model-based methods the workpiece geometry (or parts thereof) are input to start with, e.g. from CAD data.

15

One problem decisive in realizing such a system in practice is that only part of the workpiece contours can be reliably represented with known camera and illumination arrangements.

20 In DE 3545960 an attempt is made to obtain a plurality of images using just a single camera under various illumination conditions; although this enhances the probability of an edge being represented in one of these images, this is not, however, assured, for example, when at the edge the background has the same surface properties as the upper workpiece and the same spatial orientation.

25

It is only in special cases with known illumination arrangements that reliable image features materialize, for example with bright cylindrical parts resulting in a reliably bright reflecting generatrix line. This is why, despite the major require-

ment in practice, robotic devices have hitherto hardly been put to use for three-dimensional bulk gripping applications; achieving this object as applicable in general compatible with actual practice has failed to come about hitherto because certain contours under unfavorable conditions are poorly represented or not at all.

5 Getting round this problem necessitated highly involved mechanical complications; for instance, by spreading the parts on a transparent conveyor belt with back lighting and – if the parts lie one on the other – with a controllable jolting device in the hope of jolting the items apart so as to represent them fully contoured, all this, before they are even localized via an image processing system and gripped

10 by a robotic device.

Which contours can be reliably represented and which not, depends on the chance spatial orientation of the workpieces with known camera and illumination arrangements. This makes it extremely difficult to achieve reliable image analysis,

15 especially when the task involved requires a true three-dimensional position determination of the workpieces (involving in general three position parameters and three orientation parameters).

One way of getting round this, is the transition from contour-oriented processing

20 to surface three-dimensional analysis by means of structured light. This method is, however, technically extremely complicated and necessitates exotic illumination components.

One object of the invention is reliable representation of all, or as many unconcealed contours of a workpiece as possible, irrespective of the random spatial orientation of the workpiece in making use of simple standard illumination components, particularly without structured light.

25

Another object is to permit learning by simple pointing when setting up the system and data comparison in automatic operation without having to input model

30 data in advance when setting up the system.

These objects are achieved by a method as set forth in claim 1 and claim 12 and by a device as set forth in claim 18. Advantageous embodiments read from the dependent claims.

5

In accordance therewith, a method is made available for establishing a data collection with the aid of at least one imaging means and at least one illuminating device, wherein an object is imaged from at least three different imaging directions and illuminated from at least three different illumination directions, each in direct
10 light, one imaging direction each being substantially opposed to one illumination direction, so that from each of the three imaging directions at least one contour each of the object appears with a light side and a shadow side of the object, and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means, wherein the imaging directions and the
15 illumination directions, on the one hand, and the object, on the other, are movable defined relative to each other with several degrees of freedom, and the images and/or the data derived therefrom are stored in the data collection.

In one aspect of the invention images can be made in various relative positions of
20 image capture devices and illumination devices, on the one hand, and of the object, on the other.

In another aspect of the invention changes in the relative positions between the images can be captured and assigned to the images and wherein position indications assigned to the images or to the data derived therefrom are stored in the data
25 collection.

In yet another aspect of the invention several images can be made between which the position of the image capture devices and illumination devices is changed mutually.
30

In still another aspect of the invention the position of the image capture devices and illumination devices can be determined by a robotic setting.

- 5 In another aspect of the invention several images can be made between which the position of the object is changed.

In yet another aspect of the invention the position of the object can be changed by means of a robotic device.

10

A further aspect of the invention provides a data collection with images and/or data derived therefrom, as well as a computer-readable storage medium with data which form a data collection.

- 15 In another further aspect of the invention a method is made available for gripping an object from a plurality of objects with the aid of at least one imaging means and at least one illuminating device, wherein the object is imaged from at least three different imaging directions and illuminated from at least three different illumination directions, each in direct light, one imaging direction each being substantially opposed to one illumination direction, so that from each of the three
- 20 imaging directions at least one contour each of the object appears with a light side and a shadow side of the object, and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means.

- 25 In still another further aspect of the invention reference images and/or data derived therefrom contained in a data collection as set forth in claim 10 can be used.

In yet another further aspect of the invention images of the object and images or derived data in the data collection can be compared.

In yet another further aspect of the invention the illumination devices and the image capture devices can be arranged substantially star-shaped, the illumination directions as viewed from one direction comprising in pairs an angle between 75
5 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

In still another further aspect of the invention wherein each imaging can be performed substantially from the imaging directions via light from the substantially
10 opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.

15 A further aspect of the invention provides a computer-readable storage means with a method for establishing a data collection.

Still another further aspect of the invention provides a device for gripping an object from a plurality of objects with at least three image capture devices and at
20 least three direct illumination devices, wherein one image capture device each is substantially opposed to one illumination device, so that from each of the three image capture devices at least one contour each of the object can be imaged with a light side and a shadow side of the object, and substantially the complete object can be imaged by the at least three image capture devices in combination.

25

Yet another further aspect of the invention provides a device configured to use reference images and/or data derived therefrom contained in a data collection as set forth in claim 10.

In another aspect of the invention the device may further comprise a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as
5 viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

In another further aspect of the invention the device may be configured for capturing images via light from the substantially opposed illumination direction, preferably by switching means and/or by polarization and/or spectral filters and/or by
10 at least one color rendering image capture device.

The invention will now be detailed by way of the attached drawing in which:

15 FIG. 1 is a side view of the camera and illumination arrangement in accordance with the present invention;

FIG. 2 is a view of the arrangement as shown in FIG. 1 as seen vertically from above;

20

FIG. 3 is a section showing a camera and the illumination thereof in accordance with the present invention; and

FIG. 4 is a workpiece scene and three cameras as well as diagrammatic representations of the images captured by the cameras.
25

Referring now to FIG. 1 there is illustrated a side view of the camera and illumination arrangement with the cameras 1, 2, 3 and the illumination devices (shown symbolically) 11 (assigned to camera 1), 12 (assigned to camera 2) and 13 (as-

signed to camera 3) as well as the bulk workpieces 4. The fixed base as shown can, of course, be replaced, for example, by a transport conveyer or a container.

Referring now to FIG. 2 there is illustrated the arrangement as seen vertically
5 from above.

Referring now to FIG. 3 there is illustrated sectionwise a camera and the associated illumination showing the shadow 5 produced thereby at the edges 6 of the workpiece. The opposite edge 7 of the workpiece is evident, as „seen“ by the
10 camera, only under favorable conditions, for example, against a dark base, whereas the edges 6 are reliably „seen“ by the camera 1 irrespective of how bright the material is and the three-dimensional position of the workpiece. Indeed, this also applies for bright workpiece surfaces when the illumination is adapted accordingly, i.e. the edges 6 produce in the image a contour. Both workpiece sides
15 of the contour are „seen“ by the camera, namely on the one hand the workpiece surface 9 illuminated by the opposite illumination device and, on the other, the workpiece surface 9 not illuminated by the opposite illumination device. The workpiece surface 9 reflects in any case brightly since it is located approximately in the gloss angle (with dull surfaces a small light source is sufficient, but to
20 achieve this with bright surfaces a larger light source is required). In the direction of the camera a shadow 5 exists as „seen“ by the camera, i.e. visible (a shadow located on the opposite side of the workpiece would e.g. not be visible): it is in this that the surface 8 always appears darker than the surface 9, irrespective of the surface finish of the workpiece material. This is why the workpiece contour is
25 always reliably imaged as „seen“ by the camera, no matter what the background, since the contour is edged by two sides of the same workpiece.

Although the end of the shadow (shadow edge 10) likewise forms a contour, this has the inverse polarity in the image: in the camera image the brightness at the
30 workpiece contour changes from bright to dark as viewed from top to bottom, at the edge of the shadow from dark to bright in thus making it very simple to distin-

guish in image analysis workpiece contours from shadow contours (although a shadow occurring at the workpiece edge 7 would have inverted polarity, this is invisible to the camera).

- 5 Referring now to FIG. 4 there is illustrated, as viewed from above, a workpiece scene and three cameras together with the three separate images 21 (for camera 1), 22 (for camera 2), 23 (for camera 3) showing the shadow as a thick edge.

One particular advantage of the invention is that with the arrangement of at least
10 three cameras and correspondingly engineered fields of view every contour section in at least one camera is in the situation (edge 6) as shown in FIG. 3 and for this camera the contour reliably appears in the image.

A subsequent image analysis process then has all information as needed to
15 achieve type or position recognition (apart from any geometric ambiguities existing basically). All non-concealed contours of the workpiece top surface are reliably represented in at least one camera.

These highly advantageous properties in contouring are even maintained in principle when separating the channels as it reads from claim 4 or 5 is not performed,
20 i.e. when no fully developed shadow forms but just a half-shadow as is the case, for instance, when the three illumination devices opposite the cameras are formed by a single ring light and no further measures are undertaken for channel separation. Although the then resulting half-shadow is not as significant as a full shadow
25 as is achieved in channel separation, it is sufficient in most cases.

In three-dimensional analysis the particularly advantage afforded by the described arrangement with three cameras located at an angle to each other is that minor rotations of the workpiece spatially result in a significant change in a contour image
30 (it being generally the case that several contour images change at the same

time) such that three-dimensional position sensing is possible also with good numerical accuracy and teaching simply by presenting workpieces in various positions is possible without having to recourse to model information.

5 It is particularly of advantage that for three-dimensional position sensing the geometry of the workpiece edges does not need to be known when sensing is achieved by comparison with the images captured in defined relative positions in setting up the system or data derived therefrom in a reference data collection or reference data base, since in image analysis workpiece contours are very easy to
10 distinguish from shadow contours as a function of the ambient conditions (see above) without having to make use of prior knowledge as to the workpiece geometry. In approaches as known hitherto reliably distinguishing workpiece edges from shadow edges first occurred in the scope of the (in generally model-based) image analysis process; now making this distinction is done in advance and without
15 prior knowledge, which in turn greatly simplifies subsequent analysis in rendering it more robust.

Further advantages materialize from moving the cameras and illumination devices together against the workpiece. For example, when securing camera and illumination
20 device to the robotic device in setting up the system, precisely the same relative image capture and illumination situation is simulated as is later with the robotic device fixed and the part changed in position. Unanticipated effects such as e.g. dazzle and shadows occur in precisely the same way during teaching and sensing which in turn first makes teaching possible by straight presentation and
25 comparison in keeping with actual practice. This advantageous situation does not exist when cameras and illumination devices are moved separately. In other words, simple learning by presentation and sensing by comparison with that presented, without model information, is now achieved in conjunction with

- reliable and explicit contour extraction solely at body edges because of
30 the selected camera and illumination device arrangement, and

- precisely reproducible imaging by moving illumination device and camera together relative to the workpiece.

The latter is also achieved when, in addition, also cameras and illumination devices are mutually movable, but always stand in the same, or at least approximately the same, relative position to each other when capturing the image.

This property also results in multiphase functioning being easier and more reliably achievable by the robotic device following a first image capture in a first movement roughly adapting firstly the position of the cameras relative to the workpiece and then in subsequent image capture and analysis achieving fine adaptation for precise gripping. It is, of course, just as possible that the whole procedure is achievable in more than two phases in sequence or continually.

Although multi-camera arrangements with transmitted, instead of direct, light produce just as reliable contour images, these are achievable more in simple special cases possibly. This applies particularly to multidimensional position sensing; in transmitted light arrangements no illuminated surfaces of the parts are to be seen, for recognizing jumbled parts, as shown in FIG. 1, transmitted light arrangements are hardly achievable to meet the requirements of actual practice.

Referring now to FIG. 2 there is illustrated a symmetrical arrangement with 3 cameras. The arrangement and method as now described relate, of course, just as well to arrangements similar in sense but which deviate from a symmetrical geometry. Cameras and lamps do not need to be at the same level both one to the other and mutually, i.e. it is not necessary to divide the 360 degree scope in equal angles, there being no basic requirement for the fields of view to cover the 360 degree scope completely (the singular result of analysis is a function of the workpiece geometry, e.g. with symmetries or conversely with highly significant local contour shapes).

Although FIGs. 1 and 2 show arrangements with cameras directed looking in from the outside they must not necessary be directed in this way, e.g. as with workpieces with inner edges such as e.g. circular rings.

- 5 Structured illumination is not necessary, although, of course, it is just as possible to additionally use structured illumination to achieve e.g. a better separation from interference light via subsequent image processing software filters.

10 It is, of course, just as possible to achieve the described arrangement instead of with three cameras also with an arrangement of mirrors and fewer cameras arranged accordingly, and also by means of rigid or flexible light guides. The illumination devices facing the cameras may comprise, as already explained by way of the example of a ring light, just a single illumination device or ambient illumination as existing by chance relative to the cameras.

15

The invention relates, of course, not just to robotic devices but also to any manipulators with open/closed loop control.

20 A further example embodiment of the invention is an arrangement for type and/or position sensing of unordered or badly ordered, or one or more inaccurately positioned parts, particularly, bulk parts, imaged by means of cameras in direct light, particularly with the object of gripping or processing, involving

- at least three cameras being directed at the part(s) from different directions,
- 25 - an illumination device being provided for each of these cameras,
- potentially at least one part contour of a common part being in the field of view of each of the three cameras, whereby both sides of the common part can be seen by the camera, namely, on the one hand, a surface of the part illuminated by the relative opposite illumination device

in each case and, on the other, a surface of the part not illuminated by the relative opposite illumination device in each case,

the illumination devices and the three cameras, on the one hand, and the part(s), on the other, each being movable relative to the other.

5

In this context „potentially“ is to be understood that the fields of view of the cameras are oriented so that a common workpiece can be located in the fields of view with one contour each (if this is not the case, e.g. a robotic device with cameras assumes a new position to search for a workpiece; when the cameras are located
10 fixed a transport conveyer, for instance, is advanced until a common workpiece is located in the fields of view).

In another further embodiment of the invention in an arrangement for position sensing, cameras and illumination devices are fitted to a robotic device for defined
15 movement together relative to the part(s).

In yet another further embodiment thereof in an arrangement for position sensing with cameras and illumination devices not fitted to a robotic device, a part can be presented, preferably placed, particularly preferably by a robotic device in various
20 defined positions in the field of view of the cameras when setting up the system.

In still another further embodiment of the invention the illumination-image capture channels can be separated in an arrangement by switching means and/or by polarization filters and/or color filters and/or by color cameras.

25

In yet another further embodiment of the invention a method for gripping and/or processing unordered or badly ordered, or inaccurately positioned parts, particularly, bulk parts can include an arrangement for position sensing in which image capturing by at least three cameras is done separately via the illumination device
30 relative to each camera, preferably

- switching the illumination devices and image capture separate in time,
- and/or by polarized light, and polarization filters at the camera side,
- and/or by illumination devices having differing spectral ranges, and selection of spectral ranges at the camera side preferably by color cameras or spectral filters.

10 In still another further embodiment of the invention a method for gripping and/or processing unordered or badly ordered, or inaccurately positioned parts, particularly, bulk parts can include a robotic device and an arrangement for position sensing when setting up the system in which images of a sample part are captured in various relative positions of cameras and illumination devices, on the one hand, and of the sample part, on the other.

15 In yet another further embodiment of the invention in a method for gripping including an arrangement for position sensing, cameras and illumination devices can be moved in common when setting up the system for teaching the parts.

20 In still another further embodiment of the invention in a method for gripping including an arrangement for position sensing, a sample part can be presented in various defined positions in the field of view of the cameras when setting up the system for teaching the parts.

Claims

1. A method for establishing a data collection
 - 5 - with the aid of at least one imaging means and at least one illuminating device,
 - wherein an object is imaged from at least three different imaging directions and
 - illuminated from at least three different illumination directions, each in
10 direct light,
 - wherein one imaging direction each being substantially opposed to one illumination direction,
 - so that from each of the three imaging directions at least one contour of the object appears with a light side and a shadow side of the object,
 - 15 - and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means,
 - wherein the imaging directions and the illumination directions, on the one hand, and the object, on the other, are movable defined relative to each other with several degrees of freedom,
 - 20 - and wherein the images and/or the data derived therefrom are stored in the data collection.
2. The method as set forth in claim 1 wherein images are made in various
25 relative positions of image capture devices and illumination devices, on the one hand, and of the object, on the other.
3. The method as set forth in claim 2 wherein changes in the relative positions between the images are captured and assigned to the images and
30 wherein position indications assigned to the images or to the data derived therefrom are stored in the data collection.

4. The method as set forth in claim 2 or claim 3 wherein the illumination devices and the image capture devices are arranged substantially star-shaped, the illumination directions as viewed from one direction comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.
5. The method as set forth in any of the claims 2 to 4 wherein each imaging is performed substantially from the imaging directions via light from the substantially opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.
6. The method as set forth in any of the claims 2 to 5 wherein several images are made between which the position of the image capture devices and illumination devices is changed mutually.
7. The method as set forth in claim 6 wherein the position of the image capture devices and illumination devices is determined by a robotic setting.
8. The method as set forth in any of the claims 2 to 5 wherein several images are made between which the position of the object is changed.
9. The method as set forth in claim 8 wherein the position of the object is changed by means of a robotic device.
10. A data collection with images and/or data derived therefrom, structured as set forth in any of the preceding claims.
11. A computer-readable storage medium with data which form a data collection as set forth in claim 10.

12. A method of gripping an object from a plurality of objects
- with the aid of at least one imaging means and at least one illuminating device,
 - 5 - wherein the object is imaged from at least three different imaging directions and
 - is illuminated from at least three different illumination directions, each in direct light,
 - wherein one imaging direction each being substantially opposed to one
 - 10 illumination direction,
 - so that from each of the three imaging directions at least one contour each of the object appears with a light side and a shadow side of the object,
 - and substantially the complete object is imaged from the at least three
 - 15 imaging directions by the at least one imaging means.
13. The method as set forth in claim 12 wherein reference images and/or data derived therefrom contained in a data collection as set forth in claim 10 are used.
- 20 14. The method as set forth in claim 12 or 13 wherein images of the object and images or derived data in the data collection are compared.
15. The method as set forth in any of the claims 12 to 14 comprising a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees,
- 25 30 preferably 120 degrees.
16. The method as set forth in any of the claims 12 to 15 wherein image capturing is performed substantially from the imaging directions via light

from the substantially opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.

- 5 17. A computer-readable storage means comprising a program code which implements the method as set forth in any of the claims 12 to 16 when loaded in a computer.
18. A device for gripping an object from a plurality of objects
- 10
- with at least three image capture devices and
 - at least three direct illumination devices, wherein one image capture device each is substantially opposed to one illumination device,
 - so that from each of the three image capture devices at least one con-

15

 - tour each of the object can be imaged with a light side and a shadow side of the object,
 - and substantially the complete object can be imaged by the at least three image capture devices in combination.
- 20 19. The device as set forth in claim 18 configured to use reference images and/or data derived therefrom contained in a data collection as set forth in claim 10.
20. The device as set forth in claim 18 or 19 further comprising a substantially
- 25
- star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably
- 30
- 120 degrees.
21. The device as set forth in any of the claims 18 to 20 configured for capturing images via light from the substantially opposed illumination direction,

preferably by switching means and/or by polarization and/or spectral filters and/or by at least one color rendering image capture device.

- 1 -

Preliminary amendment
PCT/EP2003/010411
BSSNP09

Amendments to the claims

5 Please amend the claims as follows:

1. (original) A method for establishing a data collection
 - with the aid of at least one imaging means and at least one illuminating device,
 - 10 - wherein an object is imaged from at least three different imaging directions and
 - illuminated from at least three different illumination directions, each in direct light,
 - wherein one imaging direction each being substantially opposed to one illumination direction,
 - 15 - so that from each of the three imaging directions at least one contour of the object appears with a light side and a shadow side of the object,
 - and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means,
 - 20 - wherein the imaging directions and the illumination directions, on the one hand, and the object, on the other, are movable defined relative to each other with several degrees of freedom,
 - and wherein the images and/or the data derived therefrom are stored in the data collection.
 - 25
2. (original) The method as set forth in claim 1 wherein images are made in various relative positions of image capture devices and illumination devices, on the one hand, and of the object, on the other.

- 2 -

3. (original) The method as set forth in claim 2 wherein changes in the relative positions between the images are captured and assigned to the images and wherein position indications assigned to the images or to the data derived therefrom are stored in the data collection.

4. (currently amended) The method as set forth in claim 2 wherein the illumination devices and the image capture devices are arranged substantially star-shaped, the illumination directions as viewed from one direction comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

Deleted: or claim 3

5. (currently amended) The method as set forth in claim 2 wherein each imaging is performed substantially from the imaging directions via light from the substantially opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.

Deleted: any of the claims 2 to 4

6. (currently amended) The method as set forth in claim 2 wherein several images are made between which the position of the image capture devices and illumination devices is changed mutually.

Deleted: any of the claims 2 to 5

7. (original) The method as set forth in claim 6 wherein the position of the image capture devices and illumination devices is determined by a robotic setting.

- 3 -

8. (currently amended) The method as set forth in claim 2 wherein several images are made between which the position of the object is changed.

~~Deleted: any of the claims 2 to 5~~

9. (original) The method as set forth in claim 8 wherein the position of the object is changed by means of a robotic device.

10. (currently amended) A data collection with images and/or data derived therefrom, structured as set forth in claim 1.

~~Deleted: any of the preceding claims~~

11. (original) A computer-readable storage medium with data which form a data collection as set forth in claim 10.

12. (original) A method of gripping an object from a plurality of objects

- with the aid of at least one imaging means and at least one illuminating device,
- wherein the object is imaged from at least three different imaging directions and
- is illuminated from at least three different illumination directions, each in direct light,
- wherein one imaging direction each being substantially opposed to one illumination direction,
- so that from each of the three imaging directions at least one contour each of the object appears with a light side and a shadow side of the object,
- and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means.

- 4 -

13. (currently amended) A method of gripping an object from a plurality of objects

- with the aid of at least one imaging means and at least one illuminating device,

- wherein the object is imaged from at least three different imaging directions and

- is illuminated from at least three different illumination directions, each in direct light,

- wherein one imaging direction each being substantially opposed to one illumination direction,

- so that from each of the three imaging directions at least one contour each of the object appears with a light side and a shadow side of the object,

- and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means,

wherein reference images and/or data derived therefrom contained in a data collection as set forth in claim 10 are used.

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14. (currently amended) The method as set forth in claim 12, wherein images of the object and images or derived data in the data collection are compared.

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15. (currently amended) The method as set forth in claim 12 comprising a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

Deleted: any of the claims 12 to 14

- 5 -

16. (currently amended) The method as set forth in claim 12 wherein image capturing is performed substantially from the imaging directions via light from the substantially opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.

~~Deleted: any of the~~~~Deleted: claims 12 to 15~~

17. (currently amended) A computer-readable storage means comprising a program code which implements the method as set forth in claim 12 when loaded in a computer.

~~Deleted: any of the claims 12 to 16~~

18. (original) A device for gripping an object from a plurality of objects

- with at least three image capture devices and
- at least three direct illumination devices, wherein one image capture device each is substantially opposed to one illumination device,
- so that from each of the three image capture devices at least one contour each of the object can be imaged with a light side and a shadow side of the object,
- and substantially the complete object can be imaged by the at least three image capture devices in combination.

19. (currently amended) A device for gripping an object from a plurality of objects

~~Deleted: The~~~~Deleted: as set forth in claim 18~~

- with at least three image capture devices and
- at least three direct illumination devices, wherein one image capture device each is substantially opposed to one illumination device,
- so that from each of the three image capture devices at least one contour each of the object can be imaged with a light side and a shadow side of the object.

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- 6 -

and substantially the complete object can be imaged by the at least three image capture devices in combination, which is configured to use reference images and/or data derived therefrom contained in a data collection as set forth in claim 10.

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20. (currently amended) The device as set forth in claim 18 further comprising a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

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21. (currently amended) The device as set forth in claim 18 configured for capturing images via light from the substantially opposed illumination direction, preferably by switching means and/or by polarization and/or spectral filters and/or by at least one color rendering image capture device.

Deleted: any of the claims 18 to 20

20

- 1 -

Preliminary amendment
PCT/EP2003/010411
BSSNP09

Amendments to the claims

5 Please amend the claims as follows:

1. (original) A method for establishing a data collection
 - with the aid of at least one imaging means and at least one illuminating device,
 - 10 - wherein an object is imaged from at least three different imaging directions and
 - illuminated from at least three different illumination directions, each in direct light,
 - wherein one imaging direction each being substantially opposed to one
 - 15 illumination direction,
 - so that from each of the three imaging directions at least one contour of the object appears with a light side and a shadow side of the object,
 - and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means,
 - 20 - wherein the imaging directions and the illumination directions, on the one hand, and the object, on the other, are movable defined relative to each other with several degrees of freedom,
 - and wherein the images and/or the data derived therefrom are stored in the data collection.
 - 25
2. (original) The method as set forth in claim 1 wherein images are made in various relative positions of image capture devices and illumination devices, on the one hand, and of the object, on the other.

- 2 -

3. (original) The method as set forth in claim 2 wherein changes in the relative positions between the images are captured and assigned to the images and wherein position indications assigned to the images or to the data derived therefrom are stored in the data collection.
4. (currently amended) The method as set forth in claim 2 ~~or claim 3~~ wherein the illumination devices and the image capture devices are arranged substantially star-shaped, the illumination directions as viewed from one direction comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprising in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.
5. (currently amended) The method as set forth in ~~any of the claims 2 to 4~~ claim 2 wherein each imaging is performed substantially from the imaging directions via light from the substantially opposed illumination direction, preferably by switching and/or by polarization and/or spectral filtering and/or by use of at least one color rendering image capture device.
6. (currently amended) The method as set forth in ~~any of the claims 2 to 5~~ claim 2 wherein several images are made between which the position of the image capture devices and illumination devices is changed mutually.
7. (original) The method as set forth in claim 6 wherein the position of the image capture devices and illumination devices is determined by a robotic setting.

- 3 -

8. (currently amended) The method as set forth in ~~any of the claims 2 to 5~~
claim 2 wherein several images are made between which the position of
the object is changed.
- 5 9. (original) The method as set forth in claim 8 wherein the position of the
object is changed by means of a robotic device.
10. (currently amended) A data collection with images and/or data derived
therefrom, structured as set forth in ~~any of the preceding claims~~ claim 1.
- 10 11. (original) A computer-readable storage medium with data which form a
data collection as set forth in claim 10.
12. (original) A method of gripping an object from a plurality of objects
- 15
- with the aid of at least one imaging means and at least one illuminating
device,
 - wherein the object is imaged from at least three different imaging di-
rections and
 - 20 - is illuminated from at least three different illumination directions, each
in direct light,
 - wherein one imaging direction each being substantially opposed to one
illumination direction,
 - so that from each of the three imaging directions at least one contour
25 each of the object appears with a light side and a shadow side of the
object,
 - and substantially the complete object is imaged from the at least three
imaging directions by the at least one imaging means.

- 4 -

13. (currently amended) The A method as set forth in claim 12 of gripping an object from a plurality of objects

- with the aid of at least one imaging means and at least one illuminating device,

5 - wherein the object is imaged from at least three different imaging directions and

- is illuminated from at least three different illumination directions, each in direct light,

10 - wherein one imaging direction each being substantially opposed to one illumination direction,

- so that from each of the three imaging directions at least one contour each of the object appears with a light side and a shadow side of the object,

15 - and substantially the complete object is imaged from the at least three imaging directions by the at least one imaging means,

wherein reference images and/or data derived therefrom contained in a data collection as set forth in claim 10 are used.

14. (currently amended) The method as set forth in claim 12 ~~or 13~~ wherein
20 images of the object and images or derived data in the data collection are compared.

15. (currently amended) The method as set forth in ~~any of the claims 12 to 14~~
25 claim 12 comprising a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

30

- 5 -

16. (currently amended) The method as set forth in ~~any of the claims 12 to 15~~
claim 12 wherein image capturing is performed substantially from the im-
aging directions via light from the substantially opposed illumination di-
rection, preferably by switching and/or by polarization and/or spectral fil-
tering and/or by use of at least one color rendering image capture device.
17. (currently amended) A computer-readable storage means comprising a
program code which implements the method as set forth in ~~any of the~~
~~claims 12 to 16~~ claim 12 when loaded in a computer.
18. (original) A device for gripping an object from a plurality of objects
- with at least three image capture devices and
 - at least three direct illumination devices, wherein one image capture
device each is substantially opposed to one illumination device,
 - so that from each of the three image capture devices at least one con-
tour each of the object can be imaged with a light side and a shadow
side of the object,
 - and substantially the complete object can be imaged by the at least
three image capture devices in combination.
19. (currently amended) ~~The A device as set forth in claim 18 for gripping an~~
object from a plurality of objects
- with at least three image capture devices and
 - at least three direct illumination devices, wherein one image capture
device each is substantially opposed to one illumination device,
 - so that from each of the three image capture devices at least one con-
tour each of the object can be imaged with a light side and a shadow
side of the object.

- 6 -

and substantially the complete object can be imaged by the at least
three image capture devices in combination,
which is configured to use reference images and/or data derived therefrom con-
tained in a data collection as set forth in claim 10.

5

20. (currently amended) The device as set forth in claim 18 ~~or 19~~ further comprising a substantially star-shaped arrangement of illumination devices and image capture devices, whereby as viewed from one direction the illumination directions comprise in pairs an angle between 75 degrees and 145
10 degrees, preferably 120 degrees and as viewed from one direction the imaging directions comprise in pairs an angle between 75 degrees and 145 degrees, preferably 120 degrees.

15

21. (currently amended) The device as set forth in ~~any of the claims 18 to 20~~
claim 18 configured for capturing images via light from the substantially
opposed illumination direction, preferably by switching means and/or by
polarization and/or spectral filters and/or by at least one color rendering
image capture device.

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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/529,174	Hermann Tropic	BSSNP09

49691
IP STRATEGIES
12 1/2 WALL STREET
SUITE I
ASHEVILLE, NC 28801

INTERNATIONAL APPLICATION NO.	
PCT/EP03/10411	
I.A. FILING DATE	PRIORITY DATE
09/18/2003	09/23/2002

CONFIRMATION NO. 4337
371 FORMALITIES LETTER

OC000000017601851

Date Mailed: 12/08/2005

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Indication of Small Entity Status
- Copy of the International Application filed on 03/23/2005
- Copy of the International Search Report filed on 03/23/2005
- Copy of IPE Report filed on 03/23/2005
- Copy of Annexes to the IPE filed on 03/23/2005
- Preliminary Amendments filed on 03/23/2005
- U.S. Basic National Fees filed on 03/23/2005
- Priority Documents filed on 03/23/2005

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Translation of the application into English. Note a processing fee will be required if submitted later than 30 months from the priority date.
- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

Additionally the following defects have been observed:

- Preliminary Amendments have not been entered because Preliminary Amendment is in foreign language..
- The translations of Annexes are canceled since the translations were not submitted prior to 30 months from the priority date.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE

DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

*A copy of this notice **MUST** be returned with the response.*

SHAKEEL AHMED

Telephone: (703) 308-9140 EXT 208

PART 1 - ATTORNEY/APPLICANT COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/529,174	PCT/EP03/10411	BSSNP09

FORM PCT/DO/EO/805 (371 Formalities Notice)